

EPOC Winter Workshop 2017

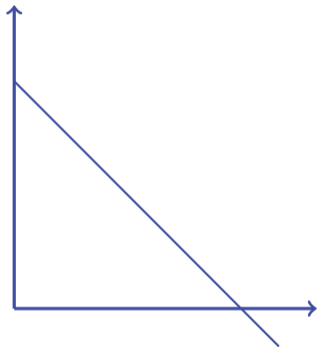
Strategic contracting in a two-stage game with risk aversion

Regan Baucke, Tony Downward, Golbon Zakeri

EPOC, The University of Auckland

r.baucke@auckland.ac.nz

$p(x + y)$



$x + y$

Cournot equilibrium

Contracts for differences

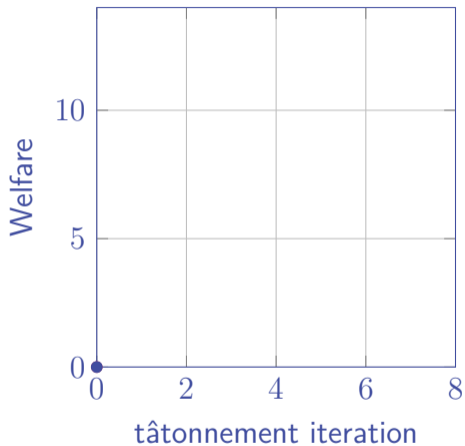
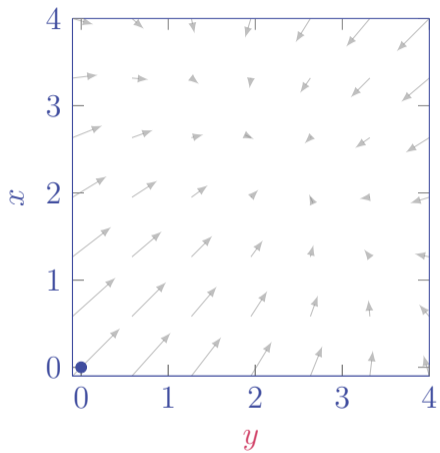
Uncertainty

Conclusions

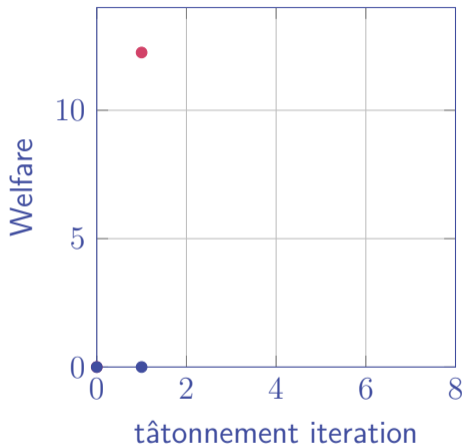
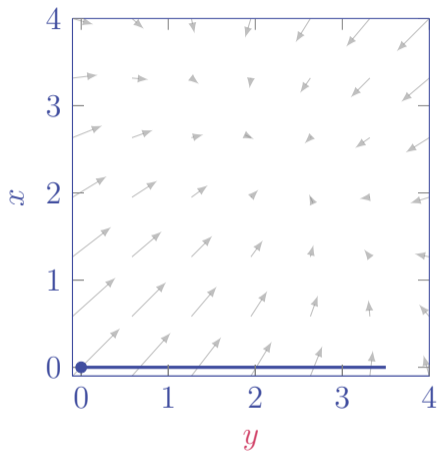
$$\max_x p(x) \times x - bx$$

$$\max_x p(x + y) \times x - bx$$

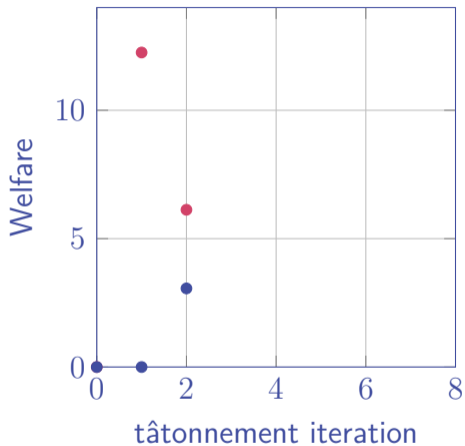
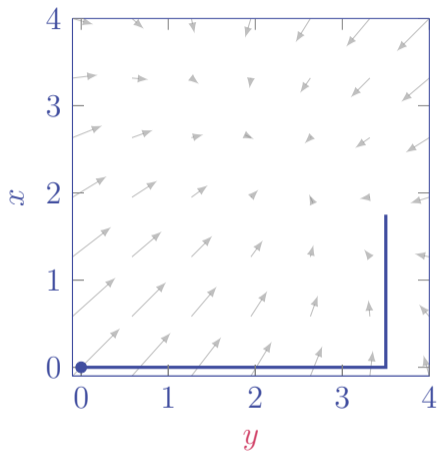
$$\max_y p(x + y) \times y - by$$



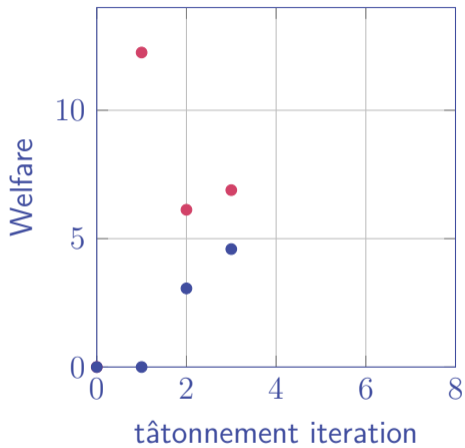
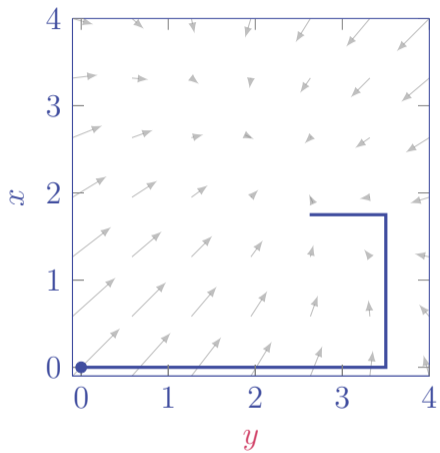
Cournot equilibrium | Duopoly



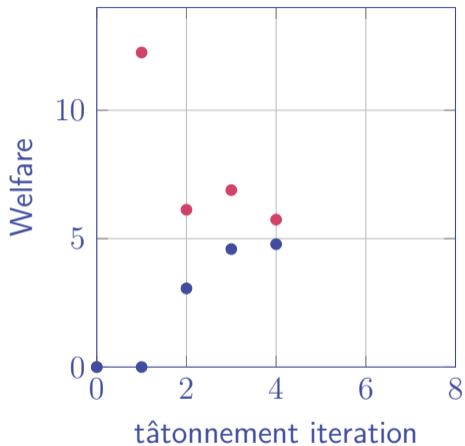
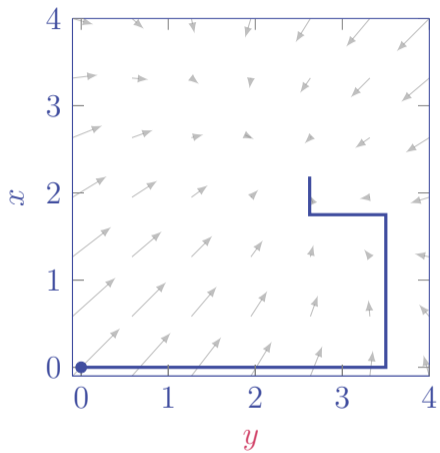
Cournot equilibrium | Duopoly

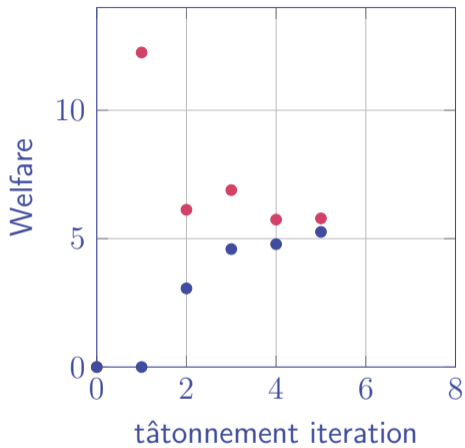
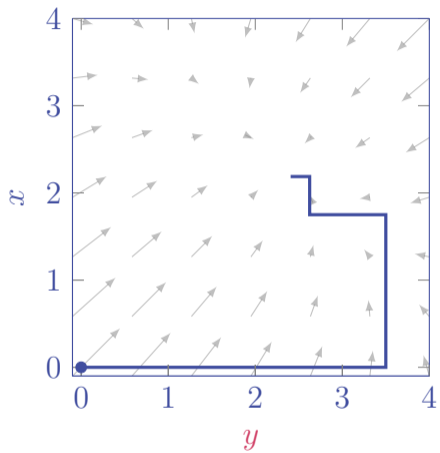


Cournot equilibrium | Duopoly

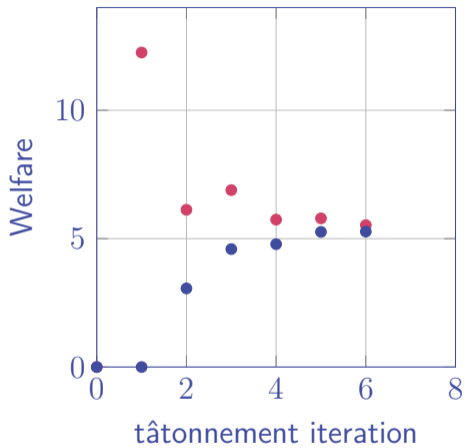
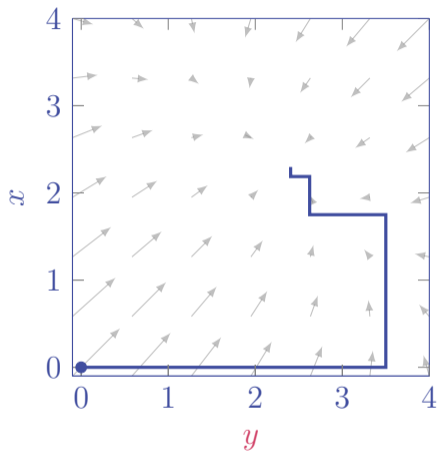


Cournot equilibrium | Duopoly

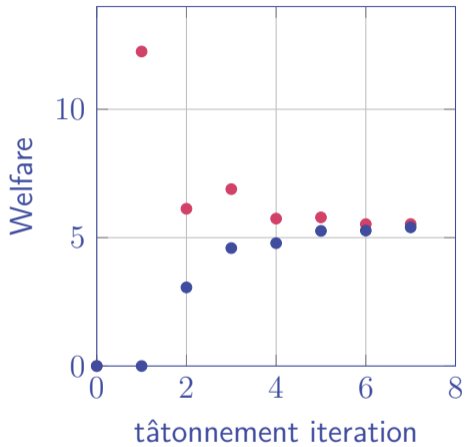
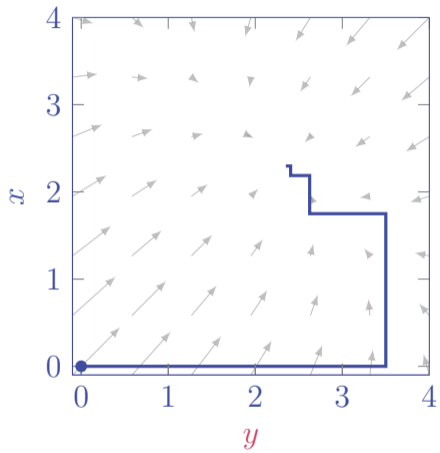




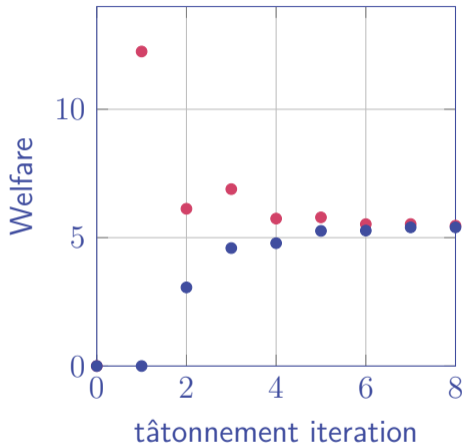
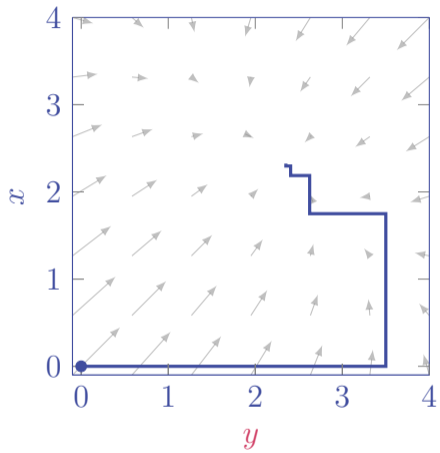
Cournot equilibrium | Duopoly



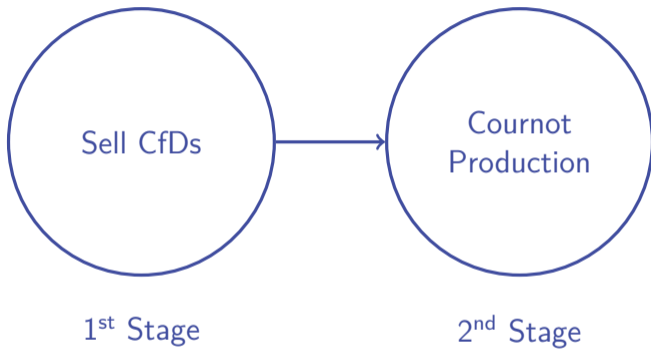
Cournot equilibrium | Duopoly



Cournot equilibrium | Duopoly



Cournot equilibrium | Duopoly

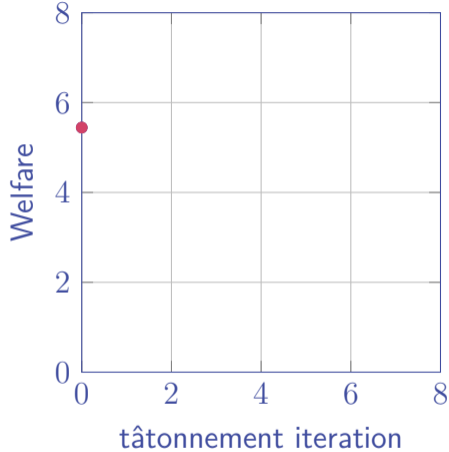
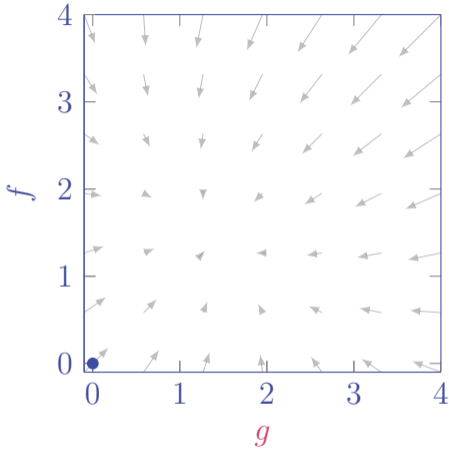


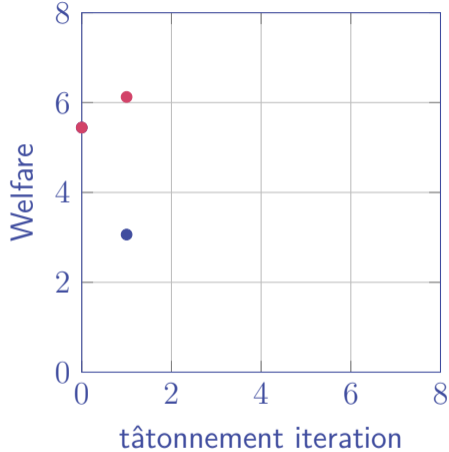
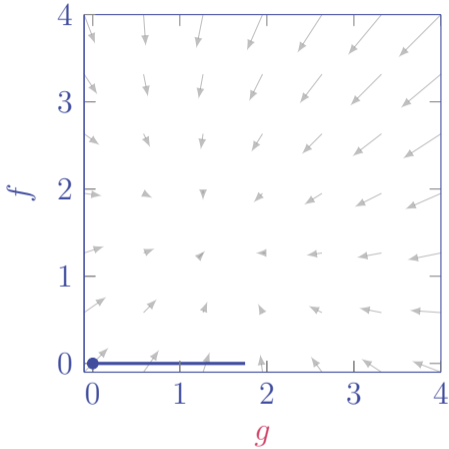
$$\begin{aligned} \max_f f \times p_{\text{con}} + \max_x p(x + y) \times (x - f) - bx \\ \text{s.t. } p_{\text{con}} = p(x + y) \end{aligned}$$

$$\max_f f \times p_{\text{con}} + \max_x p(x + y) \times (x - f) - bx$$

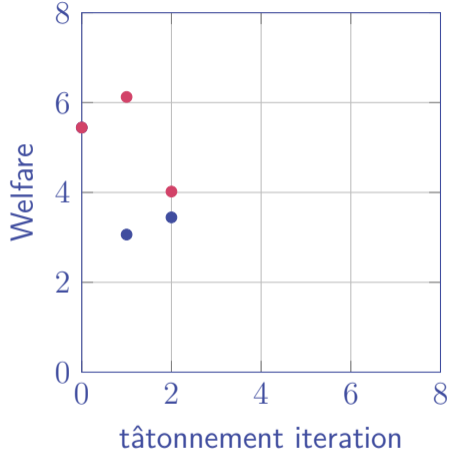
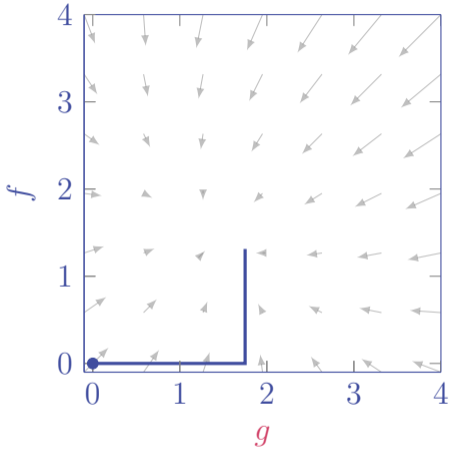
s.t. $p_{\text{con}} = p(x + y)$

$$\begin{aligned} \max_f f \times p_{\text{con}} + \max_x p(x + y) \times (x - f) - bx \\ \text{s.t. } p_{\text{con}} = p(x + y) \end{aligned}$$

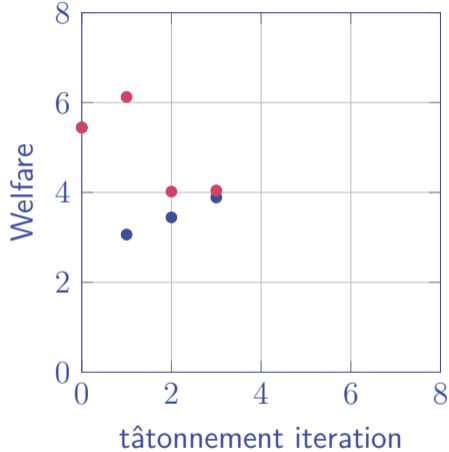
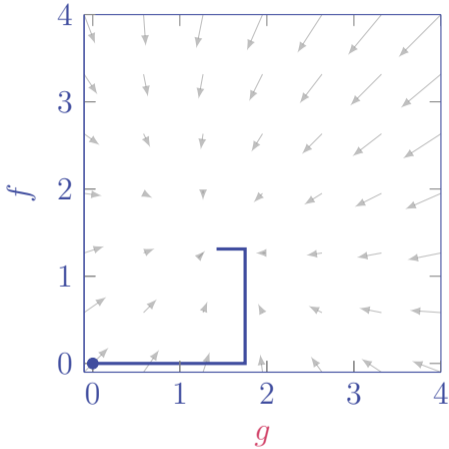


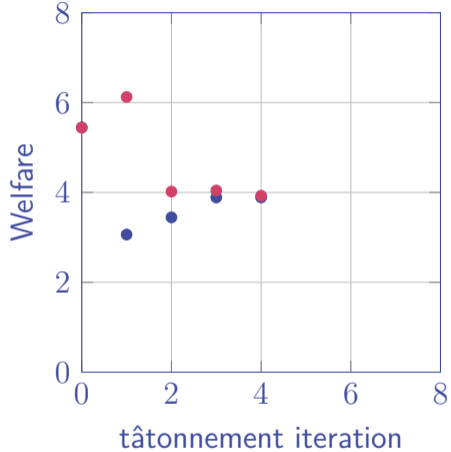
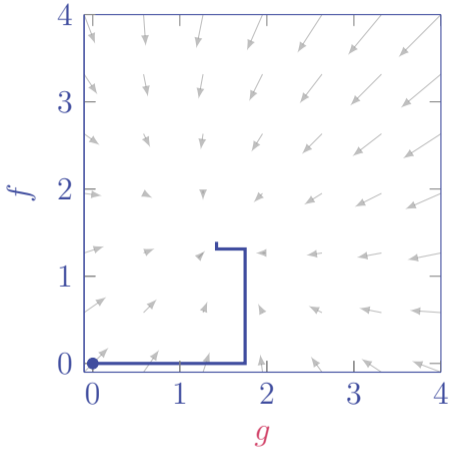


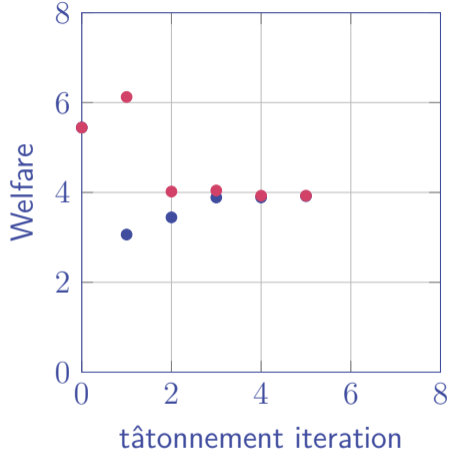
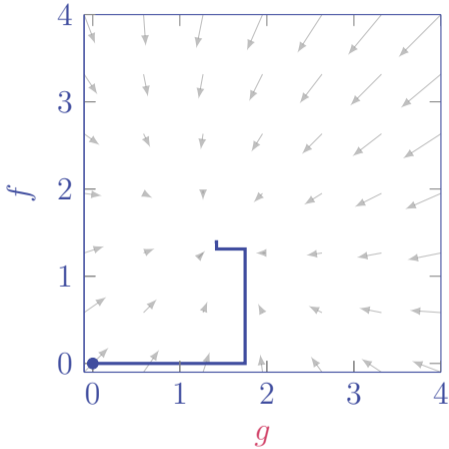
Contracts for differences | One player contracts

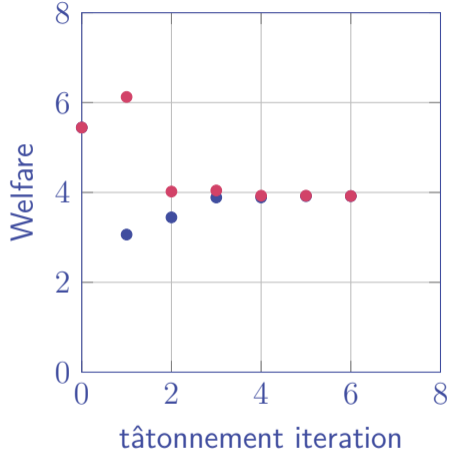
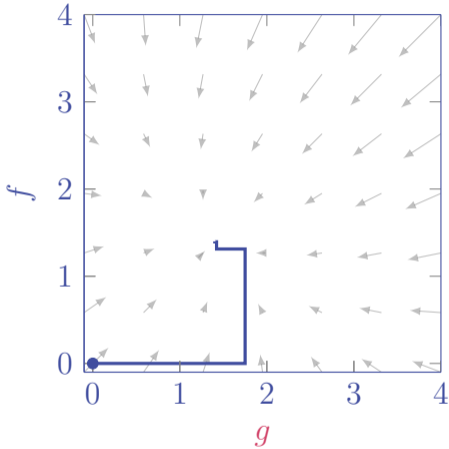


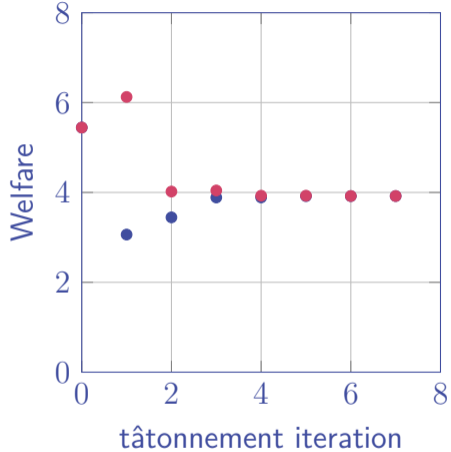
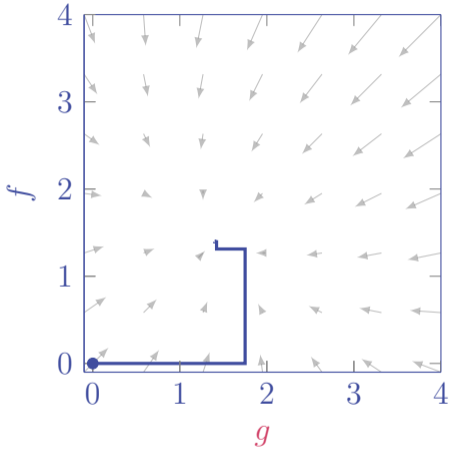
Contracts for differences | One player contracts

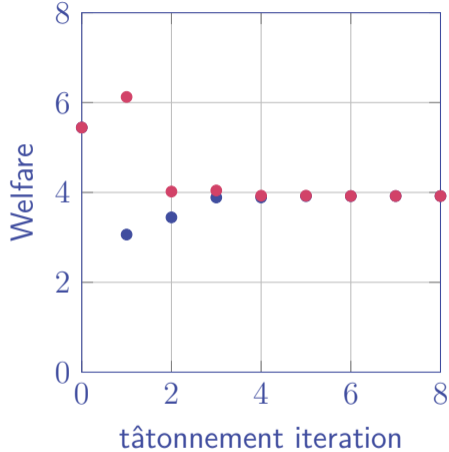
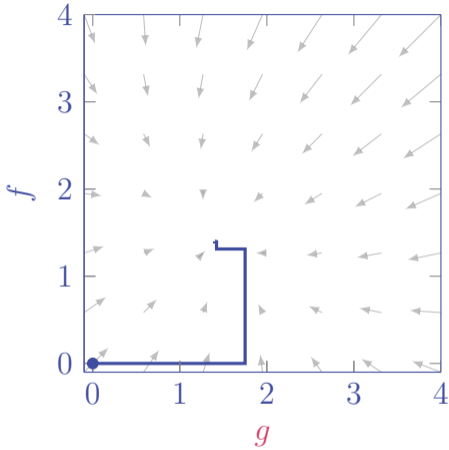


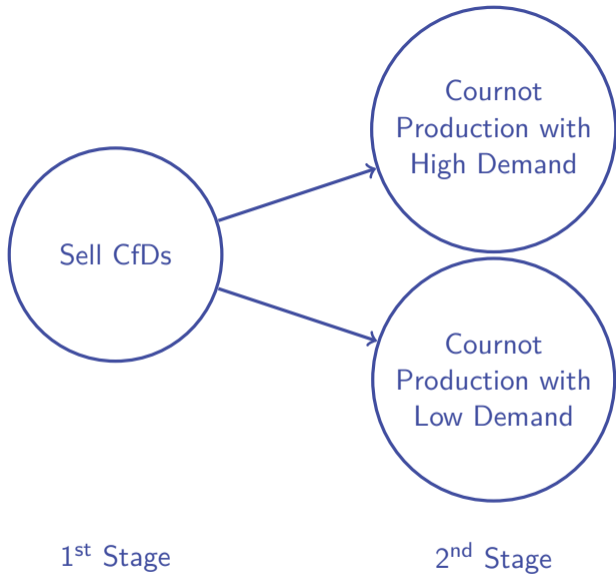






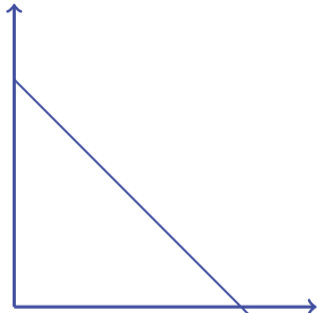






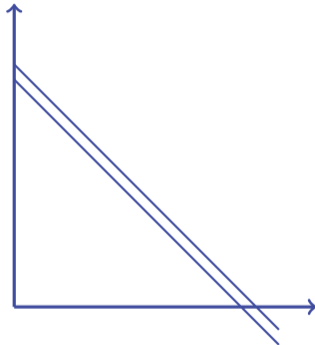
Uncertainty | Random demand curve

$p(x + y)$



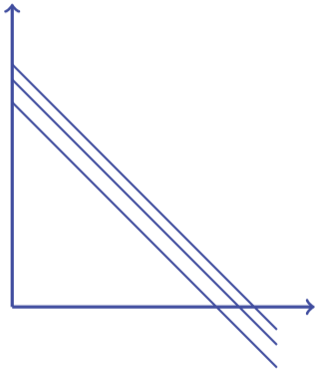
$x + y$

$p(x + y)$



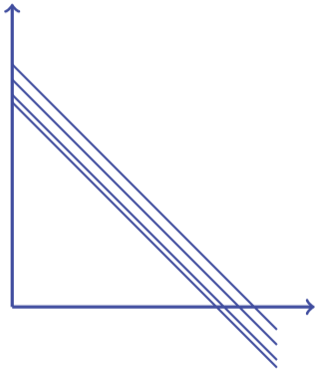
$x + y$

$p(x + y)$



$x + y$

$p(x + y)$



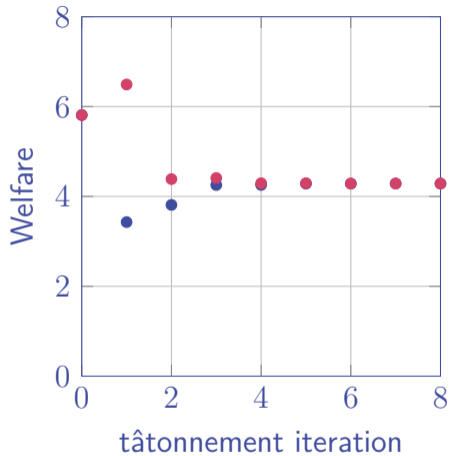
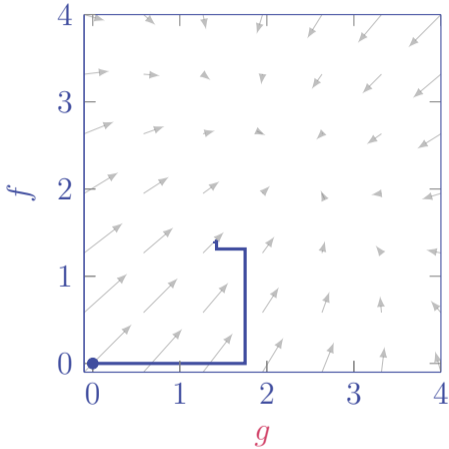
$x + y$

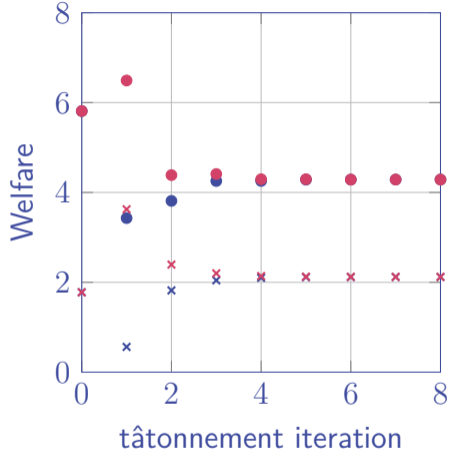
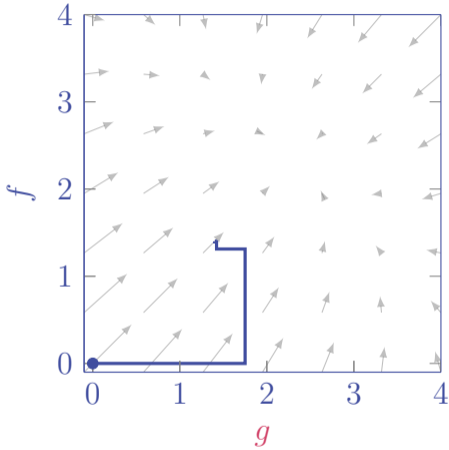
$$\begin{aligned} \max_f \quad & f \times p_{\text{con}} + \mathbb{E} \left[\max_{x_\omega} p_\omega(x+y) \times (x_\omega - f) - b x_\omega \right] \\ \text{s.t.} \quad & p_{\text{con}} = \mathbb{E} [p_\omega(x+y)] \end{aligned}$$

$$\max_f f \times p_{\text{con}} + \mathbb{E}[\max_{x_\omega} p_\omega(x+y) \times (x_\omega - f) - bx_\omega]$$

$$s.t. \quad p_{\text{con}} = \mathbb{E}[p_\omega(x+y)]$$

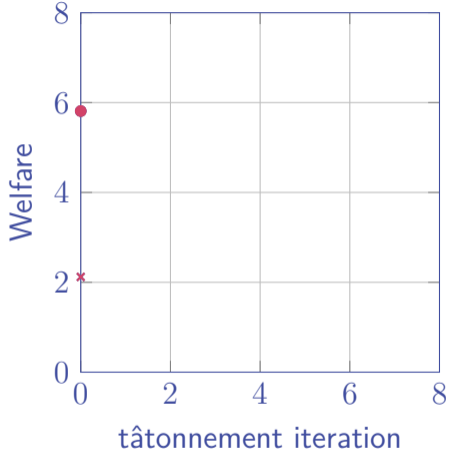
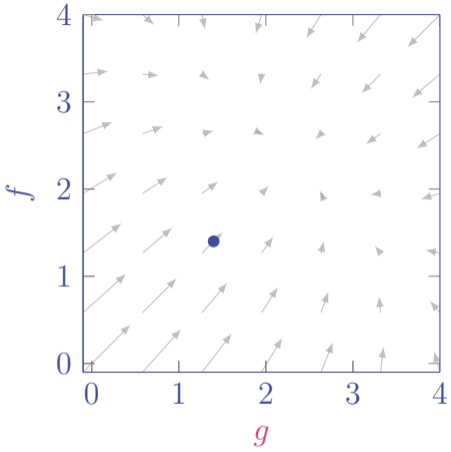
$$\begin{aligned} \max_f \quad & f \times p_{\text{con}} + \mathbb{E}[\max_{x_\omega} p_\omega(x+y) \times (x_\omega - f) - bx_\omega] \\ \text{s.t.} \quad & p_{\text{con}} = \mathbb{E}[p_\omega(x+y)] \end{aligned}$$

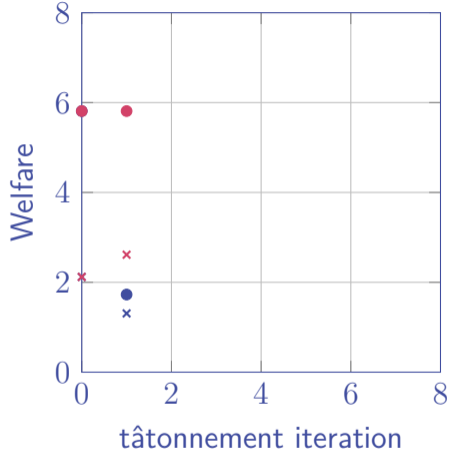
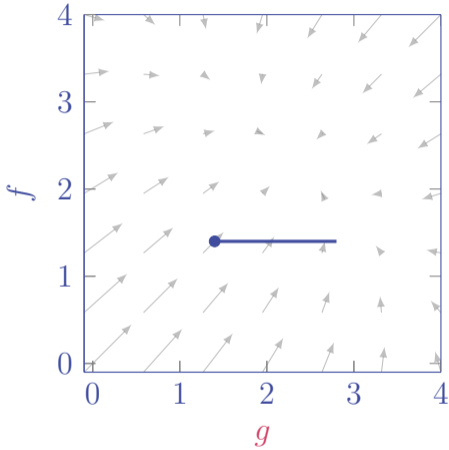


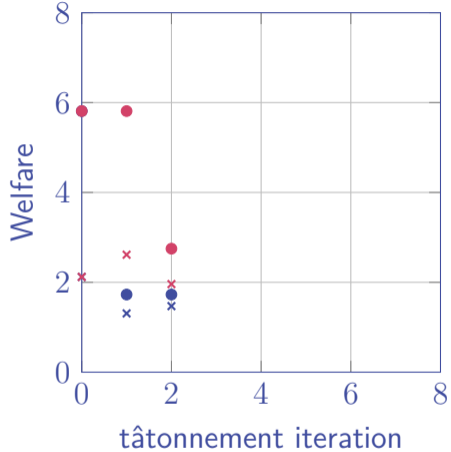
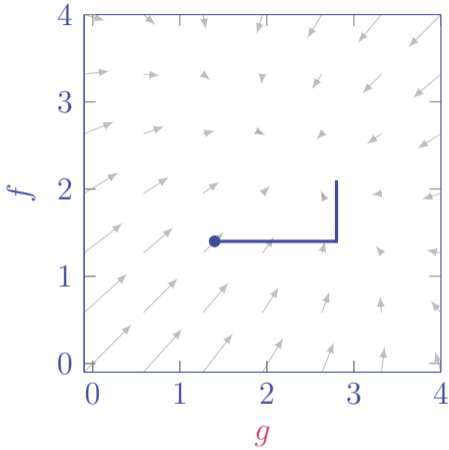


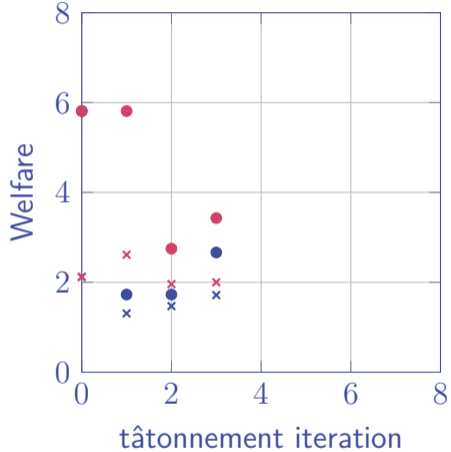
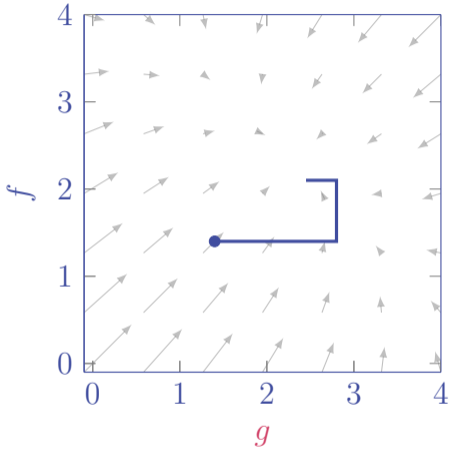
$$\max_f f \times p_{\text{con}} + \rho \left[\max_{x_\omega} p_\omega(x+y) \times (x_\omega - f) - bx_\omega \right]$$

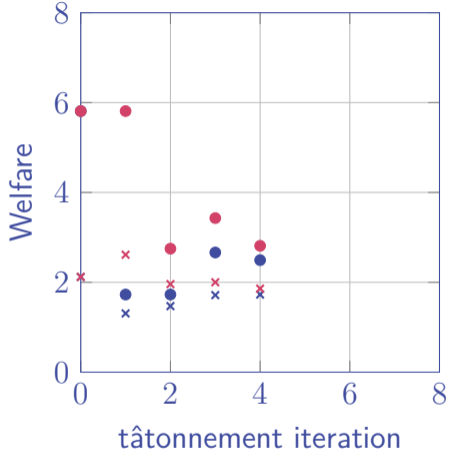
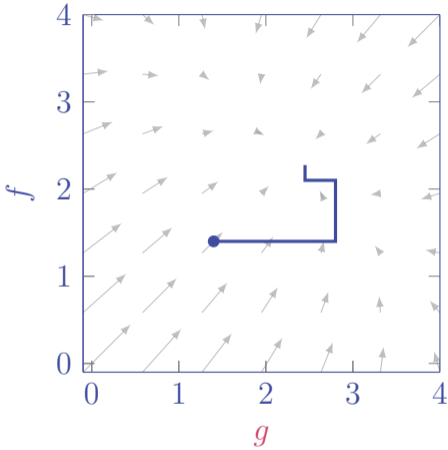
$$s.t. \quad p_{\text{con}} = \mathbb{E}[p_\omega(x+y)]$$

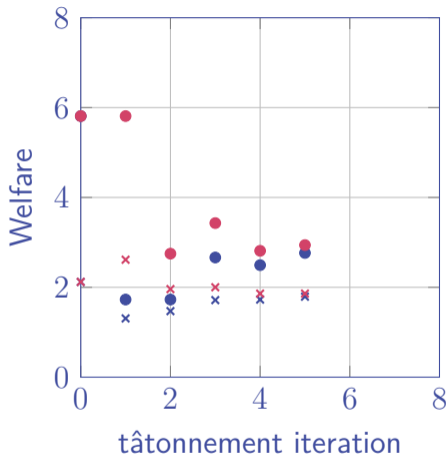
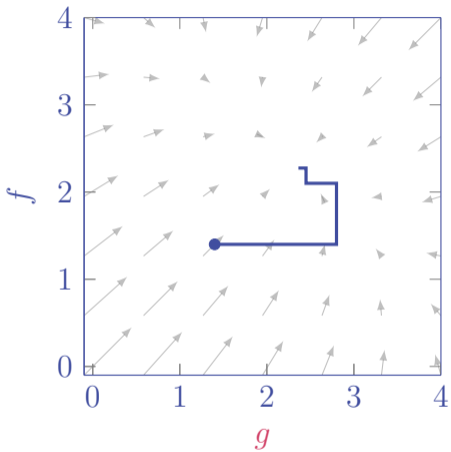


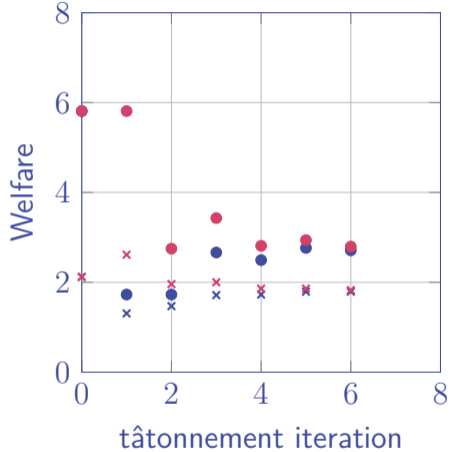
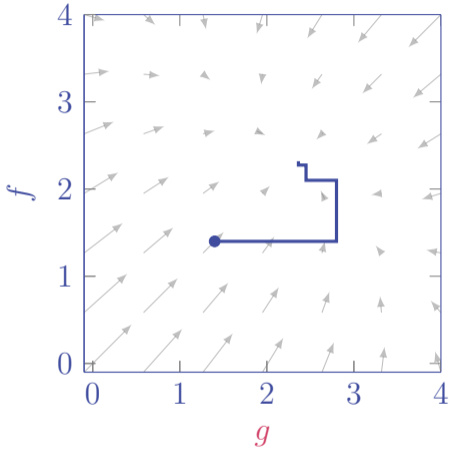


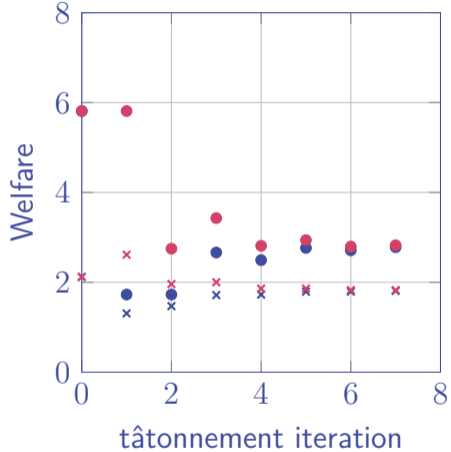
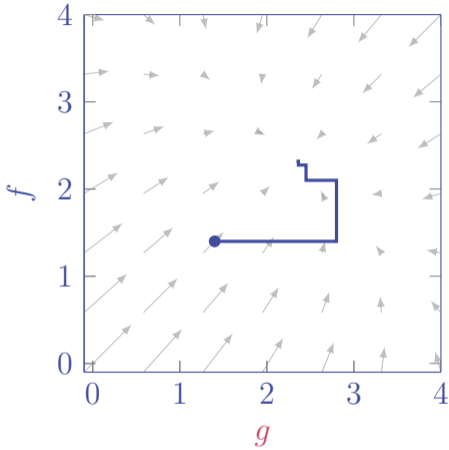


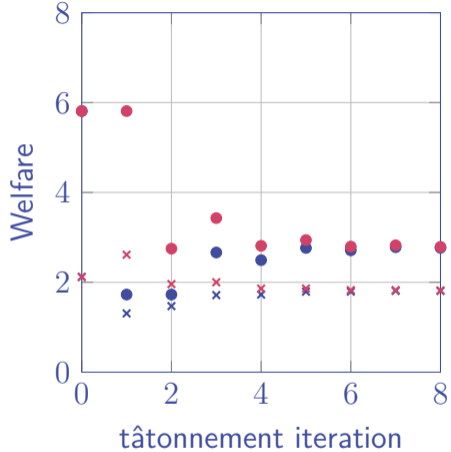
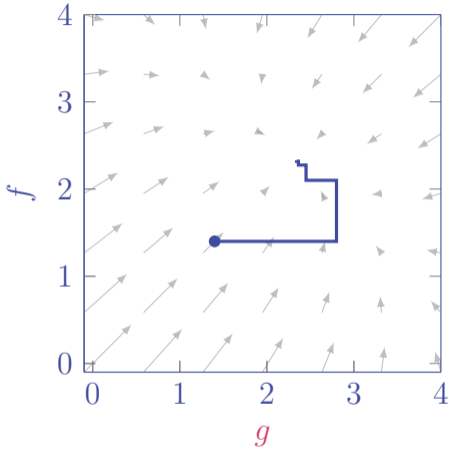




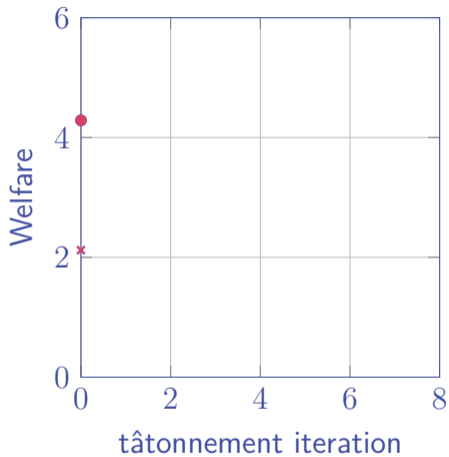
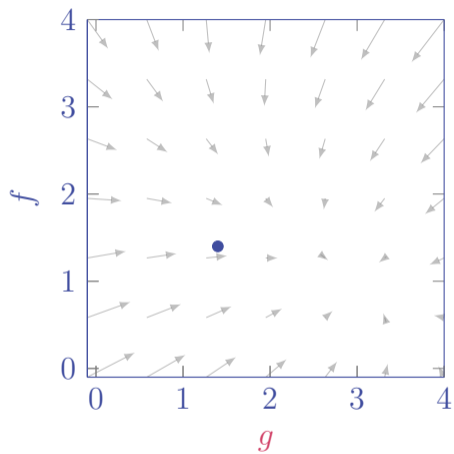


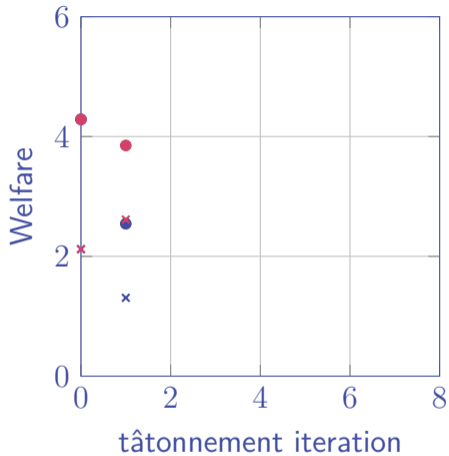
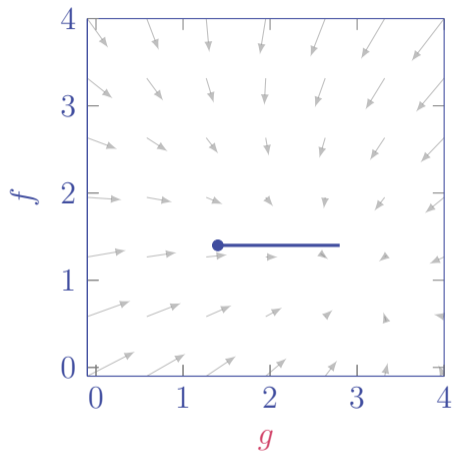


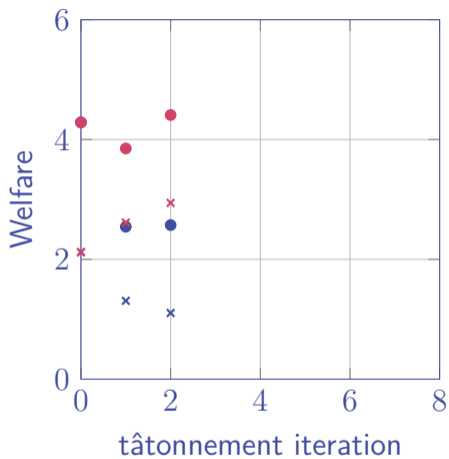
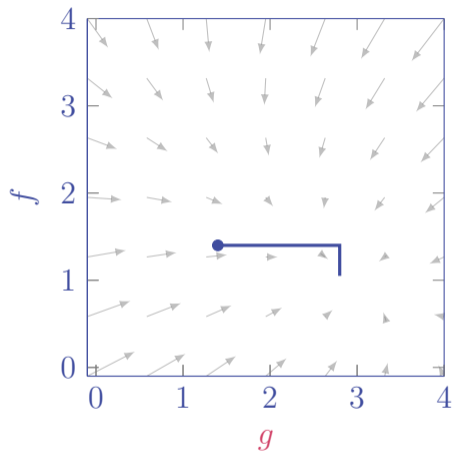


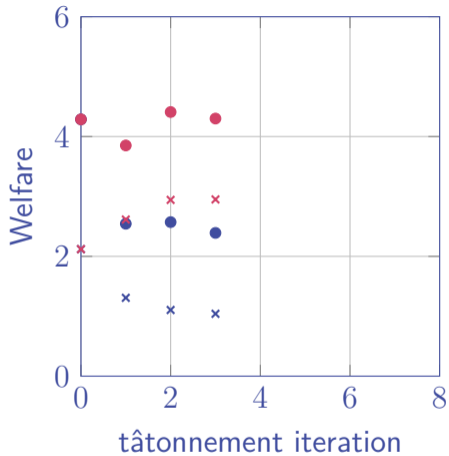
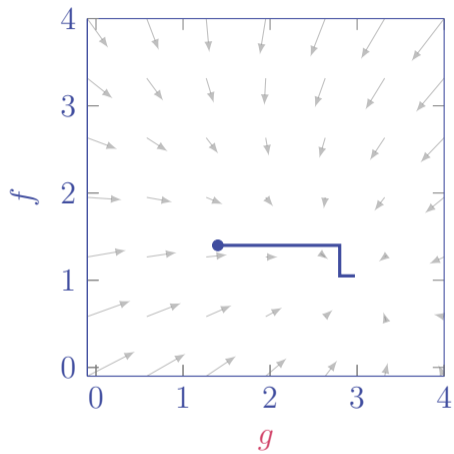


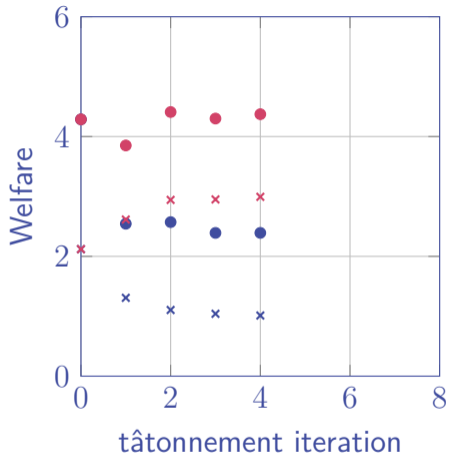
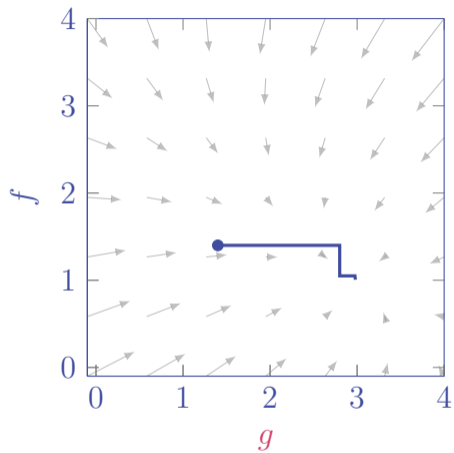
What if players have **asymmetric**
risk attitudes?

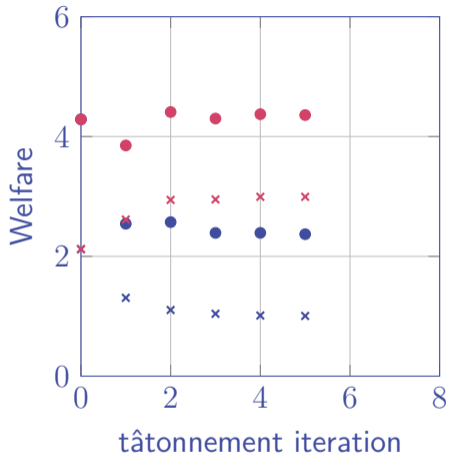
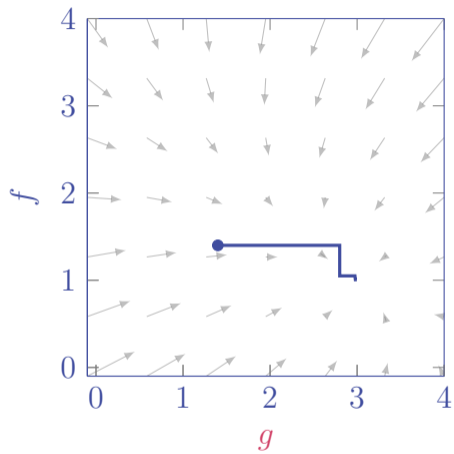


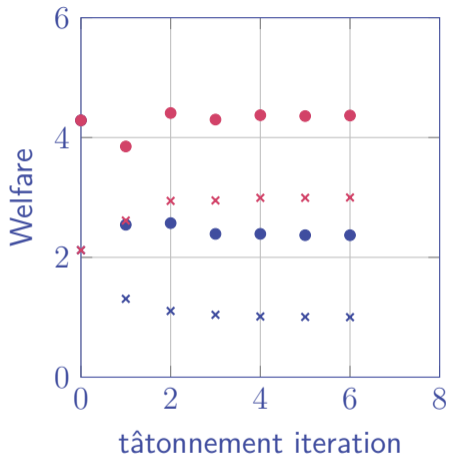
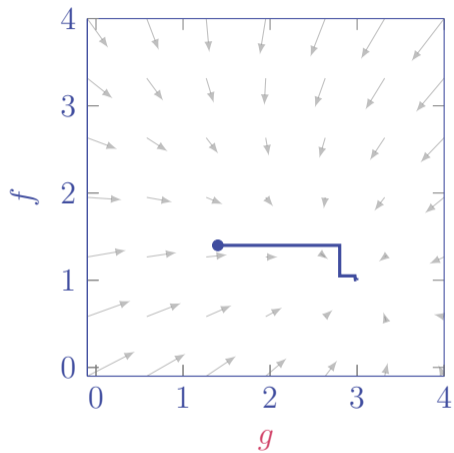


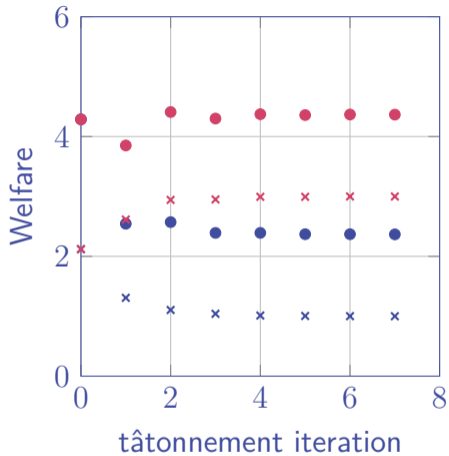
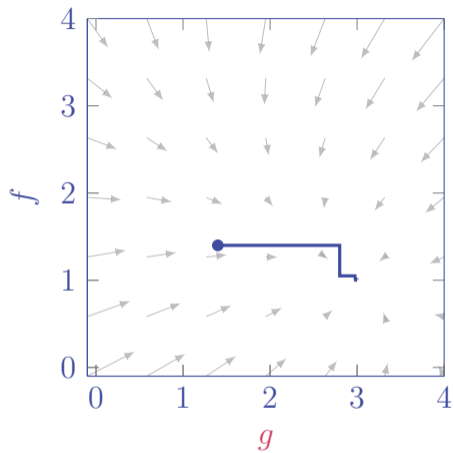


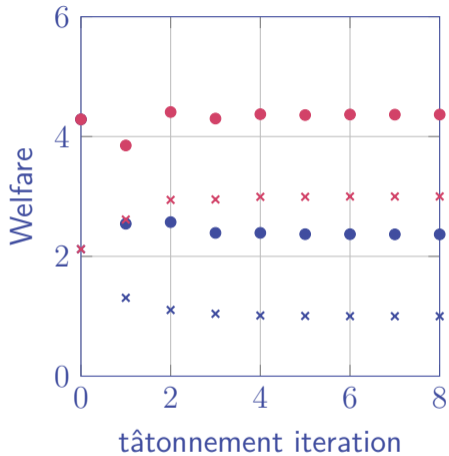
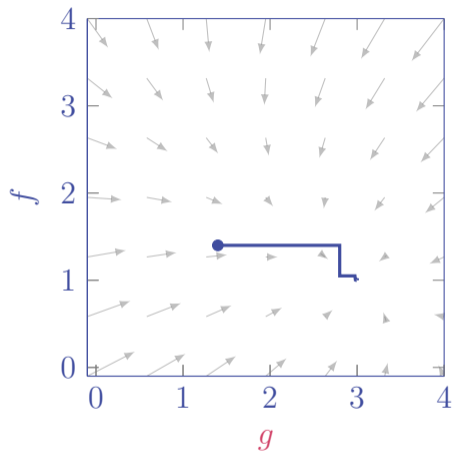












What does it all mean?

Cournot equilibrium

Contracts for differences

Uncertainty

Conclusions

- [1] Blaise Allaz and Jean-Luc Vila. Cournot Competition, Forward Markets and Efficiency. *Journal of Economic Theory*, 59(1):1–16, 1993.
- [2] Blaise Allaz. Oligopoly, uncertainty and strategic forward transactions. *International Journal of Industrial Organization*, 10(2):297–308, 1992.